

COMPARATIVE ANATOMY OF URINOGENITAL DUCTS:

FEMALE OVIDUCTS

- a) **Branchiostoma**: No genital ducts.
- b) **Cyclostomes**: No genital ducts.
- c) **Fishes**:
 - a. In **Elasmobranchs** and **lungfishes**, the **Müllerian** ducts function as the oviducts. The Müllerian duct or oviduct differentiates into four regions: **funnel**, **shell gland**, **isthmus**, and **uterus**. Funnel receives the ova from ovary, shell gland secretes albumen and mucus or egg shell around it. The isthmus connects the shell gland to the uterus. The uterus nutritionally supports embryos if they are held in the oviduct for an extended period. Oviducts may join before they enter the **cloaca**, or they may enter separately.
 - b. **Teleost fishes** have a short oviduct that starts directly from the ovaries. They are not mullerian ducts and are often called **Egg Ducts**. There is no cloaca in teleosts.
- d) **Amphibians**: **Müllerian** ducts function as oviducts. They are long and convoluted. Posteriorly each oviduct dilates to form **uterus/ovisac** that open independently into cloaca.

In **amniotes**, remnants of the **mesonephros** may persist in larval stages, but adults have **metanephric** kidneys drained exclusively by new paired ducts, the ureters (metanephric ducts). In females, the **archinephric** ducts are rudimentary. The oviducts (**Müllerian** ducts) persist in their roles of transporting ova from the ovaries and supporting the embryo while it is in transit.

- e) **Reptiles**: The **oviducts** are long and open into the coelom by large, slit-like **ostia**. The right oviduct is shorter than the left in snakes. Posteriorly, the oviducts dilate to form the **shell gland** or **ovisac**, and open independently into the cloaca. Upper parts of oviduct have **glandular lining** in crocodilians, chelonians and *Sphenodon* that secrete albumen over the egg. Many reptiles have **cloacal glands** also, which release a secretion with nauseating odour and a defensive role.
- f) **Aves**: Both the oviducts (**Müllerian ducts**) appear in the embryo but only the left grows and becomes functional in the adult. A vestige of the right persists attached to the cloaca. The left oviduct is a long, muscular, convoluted tubule. The anterior end widens to form the **oviducal funnel/infundibulum** that serves to receive the ova released from the ovary. Next is the glandular part **Magnum**, where albumen is laid down around the egg. Then comes the **isthmus** which secretes the shell membranes around the egg. The terminal part is known as **vagina**, it secretes mucus to facilitate laying of eggs. Both oviducts are functional in certain birds of prey.
- g) **Mammals**: mammals have paired oviducts (Müllerian ducts). Each oviduct consists of anterior narrow **Fallopian tube** and a posterior wide **uterus**. The former opens into coelom by an ostium bordered by a fimbriated

fallopian funnel/ infundibulum. The uteri terminate in vagina through cervix. However in monotremes, only the left oviduct is functional.

TYPES OF UTERI IN MAMMALS:

Eutherian mammals possess one of the four types of uterus on the basis of degree of fusion of uterus with vagina at the distal end:

1. **Duplex uterus:** uteri distinct and open separately into the vagina (elephants, many rodents and some bats. There may even be two separate vaginas for each uterus that
2. **Bipartite uterus:** uteri partly fused and open by a single aperture into the vagina (most carnivores, pigs, cattle, some rodents, few bats)
3. **Bicornuate uterus:** uteri over half fused (rabbit, whales, sheep, insectivores, most bats, some carnivores, hoofed mammals). The uterus has two horns/cornua in which the young develop. A uterus with two horns may have two totally separate passageways within the body of the uterus, although this is not discernible from the external view. One horn may be larger and longer than the other, the blastocysts implant in that horn, even though both ovaries produce viable eggs.
4. **Simplex uterus:** uteri completely fused (Armadillo, Apes, Humans). Fusion commences at the ends of short oviducts and there are no uterine horns. Blastocysts implant in the body of the uterus and there is only one fetus per pregnancy. Armadillos are exceptional: they give birth to identical quadruplets.

MALE URINOGENITAL DUCTS:

Cyclostomes:

- No genital ducts present. Sperm are shed into the coelom and exit via abdominal pore.
- The archinephric ducts drain the kidneys exclusively.

Fishes:

Elasmobranchs:

- Each anterior 'reproductive' kidney has short tubules that join the testis to the archinephric duct. These tubules within the anterior part of the kidney function as an epididymis.
- Accessory urinary ducts, distinct from the archinephric ducts, are usually present to serve the posterior 'uriniferous' kidney.

Bony fishes

- The archinephric ducts drain the kidneys and may receive sperm from the testes also.
- A separate duct system forms a testicular duct, which is not homologous to the archinephric duct. Some teleosts, such as salmonids, lack sperm ducts entirely.

Tetrapods:

Amphibians: Several genital duct configurations can occur.

- In ***Necturus*** and a few other species, the archinephric ducts transport both sperm from the testes and urine from the uriniferous kidneys.
- In all frogs and a few species of salamanders, tiny ducts that reach directly from the testes to the archinephric ducts bypass the anterior

part of the kidneys. Elimination from the uriniferous kidneys occurs exclusively via the accessory urinary ducts.

Amniotes (reptiles, aves and mammals):

- The archinephric duct (vas deferens) transports sperm exclusively. Several mesonephric tubules of the embryonic kidney may contribute to the epididymis that connects each testis to a vas deferens.
- Each amniote kidney is drained by a new duct, the **ureter** (**metanephric** duct).

Points to remember:

- The **pronephric** duct usually persists and is renamed the **mesonephric (Wolffian)** duct or the **opisthonephric** duct (if it extends till the caudal end of coelom), respectively.
- In males, this duct transports sperm and is then called the **Vas deferens**.
- In females, it is known embryologically as the Wolffian duct.
- The **metanephric duct** is commonly renamed as the **ureter**.
- In females, the **archinephric (mesonephric)** ducts tend to function only within the urinary system. The Müllerian duct arises embryologically next to the archinephric (wolffian) duct.
- In males, the Müllerian duct regresses, but in females, the Müllerian ducts become the oviducts of the reproductive system.

Duct	Fate
Archinephric duct → Pronephric duct → Mesonephric duct (Wolffian duct)	Vas deferens in male genital system
Mullerian duct	Oviduct in female genital system
Metanephric duct	Ureter (urinary duct)